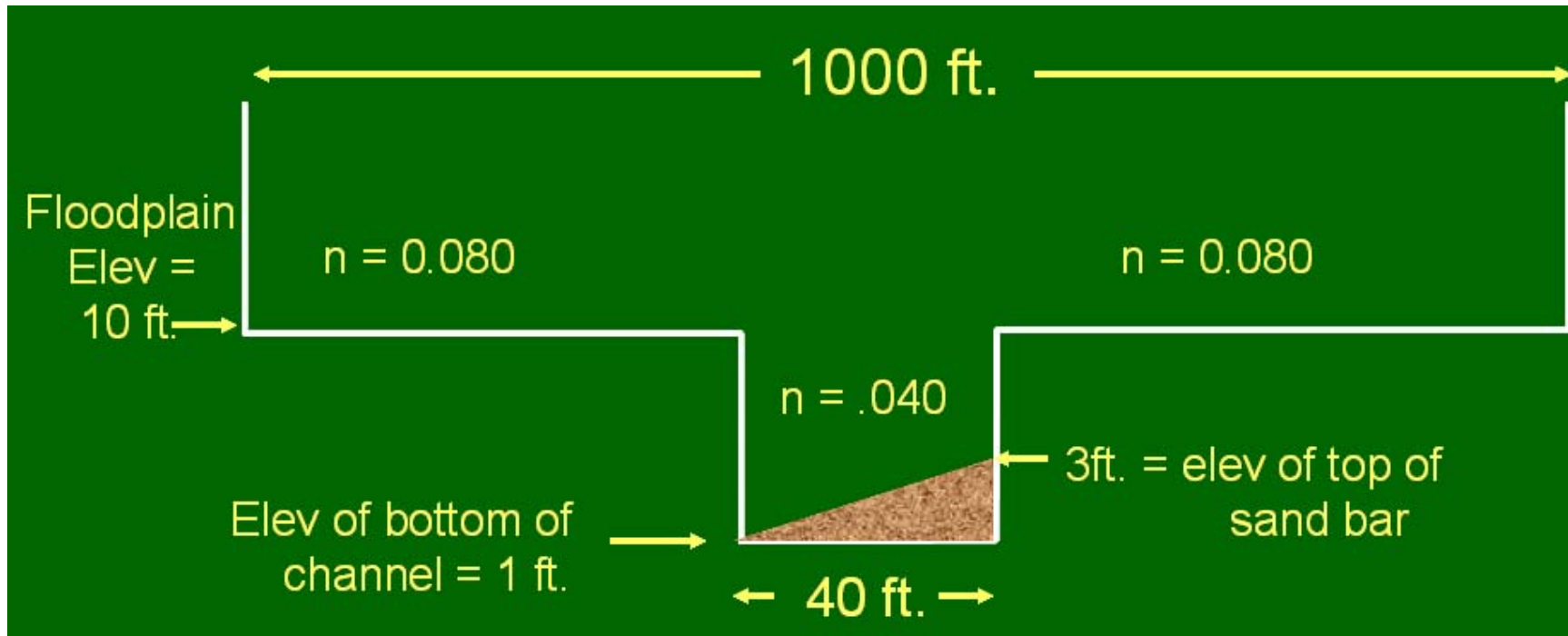## *Exercise 5 - Rating Curve Development*

- Develop and plot on the attached logarithmic graph paper a theoretical rating for the channel shown below. Assume the sand bar forms a section control.  Also, assume that the weir equation applies for the sand bar and that Manning's equation applies for the rest of the channel. When channel control is in effect, the sand bar will be either drowned out or will be washed out. Therefore, <u>the area and wetted perimeter of the sand bar should be disregarded when using Manning's equation</u>.

| Weir equation: | Manning equation: |
|---|---|
| $Q = CLH^{3/2}$ <br> where <br> C = 2.5, <br> L = Top width, in feet <br> H = Average depth of flow, in feet | $Q = \dfrac{1.486}{n} AR^{2/3} S^{1/2}$ <br> where: <br> n = roughness coefficient <br> A = cross sectional area <br> R = Hydraulic Radius (A / WP) <br> S = Energy slope (assume to be <br> same as water surface slope) <br> ( = 0.0009) |

**Schematic diagram of channel**



1000 ft.

Floodplain
Elev =
10 ft.

n = 0.080

n = 0.080

n = .040

3ft. = elev of top of
sand bar

Elev of bottom of
channel = 1 ft.

40 ft.

A. Use the weir equation to complete the table below:

| GH | L | Ave. H | Q |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 1.5 | 10 | 0.25 | 3.12 |
| 2 | 20 | 0.5 | 17.7 |
| 2.5 | | | |
| 3 | | | |
| 4 | 40 | 2 | 283 |
| 5 | 40 | 3 | 520 |
| 6 | 40 | 4 | 800 |

B. Now use Manning's equation to complete this table:

| G.H. | Main Channel | | | | Overbank channel | | | | Q(Total) |
| | A | WP | R 2/3 | Q(main) | A | WP | R 2/3 | Q(over) | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 80 | 44 | 1.49 | 133 | | | | | 133 |
| 4 | 120 | 46 | 1.9 | 253 | | | | | 253 |
| 5 | | | | | | | | | |
| 6 | 200 | 50 | 2.52 | 562 | | | | | 562 |
| 7 | 240 | 52 | 2.77 | 742 | | | | | 742 |
| 8 | 280 | 54 | 3 | 935 | | | | | 935 |
| 9 | 320 | 56 | 3.2 | 1140 | | | | | 1140 |
| 11 | 400 | 58 | 3.62 | 1620 | 960 | 962 | 1.00 | 530 | 2150 |
| 12 | | | | | | | | | |
| 14 | | | | | | | | | |
| 16 | 600 | 58 | 4.75 | 3180 | 5760 | 972 | 3.27 | 10500 | 13700 |
| 18 | 680 | 58 | 5.16 | 3910 | 7680 | 976 | 3.96 | 16900 | 20800 |
| 20 | 760 | 58 | 5.56 | 4710 | 9600 | 980 | 4.58 | 24500 | 29200 |

C. Use the paper on the next page and the data in the tables above to plot the rating using an appropriate offset.